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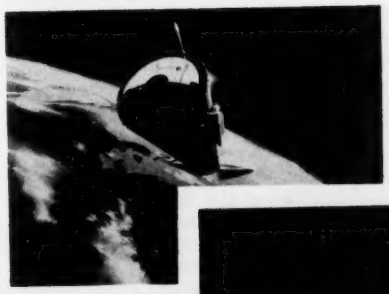

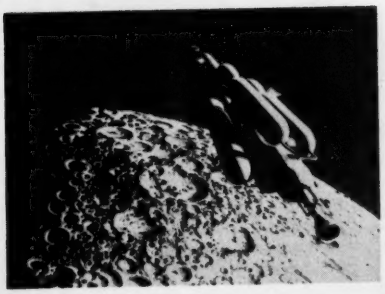

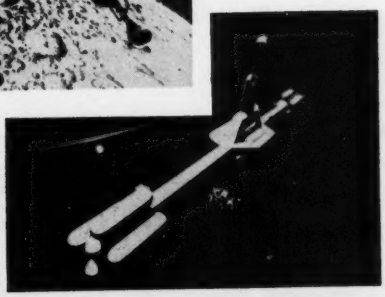

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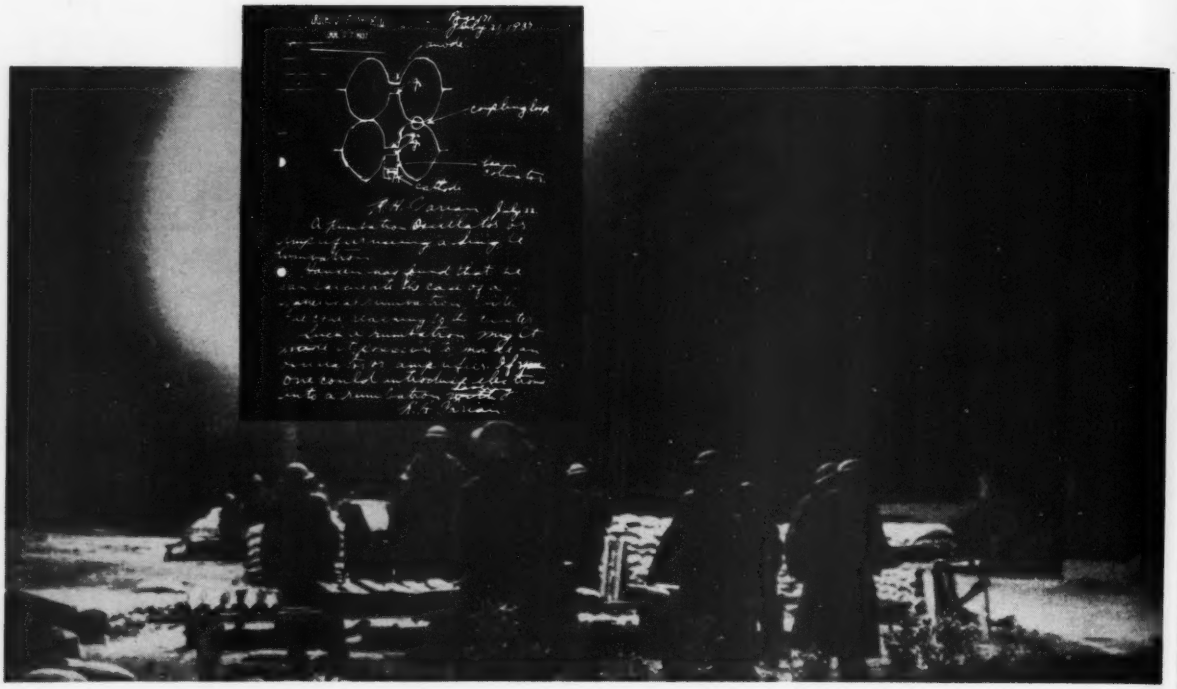

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NEXT MONTH IN DATA

The January 1960 edition of Government R&D DATA will feature the AIR RESEARCH DEVELOPMENT COMMAND. We are very thankful to the fine public information staff out at Andrews AFB, ARDC headquarters, for the hard work and resourcefulness they have contributed to the formulation of this ARDC issue.

Message from

THE DIRECTOR OF ARPA

BRIG. GEN. AUSTIN W. BETTS
Director, Advanced Research Projects Agency

Formerly Military Assistant to the Director of Defense of Research and Engineering for Guided Missiles in the Office of the Secretary of Defense, General Betts has had an excellent background for the new post of Director of ARPA which he assumed 8 December 1959.

Graduating from the U. S. Military Academy in 1934, Austin W. Betts went on to receive his MS degree from the Massachusetts Institute of Technology in 1938. He has served the past 26 years of his life in the U. S. Army.

General Betts tells DATA that he favors the climate of the duty station he once had at Los Alamos, New Mexico, that he reads Time, Life and various technical journals. He is interested in photography and likes choir music. He enjoys swimming as his favorite sport. General Betts drives a Pontiac and has a Hillman for his wife, the former Edna Paterson of St. Paul, Minnesota. The Betts family has reared three children: 22-year-old Jerry, 19-year-old Lee, and Lynn who is 10 years old. Born 22 November 1912 at Westwood, New Jersey, General Betts is a good looking man who smiles frequently. General Betts has a wide interest in new concepts but approaches all proposals with careful inspection.

We are living in an age of technology, proceeding from discoveries in infinitestimal particles to the infinity of outer space. Our progress has been largely due to research efforts during the past two decades with each new breakthrough opening new vistas for the generation of scientific investigations. The Department of Defense has not only played a critical role in accelerating our technological growth, it occupies a position of trust which requires ever more advanced research activity to provide for continuing national security. In the important fields of advanced exploratory research, ballistic missile defense, research associated with the nuclear test moratorium, solid propellant chemistry and materials research, the Advanced Research Projects Agency will continue to support and encourage the expansion of scientific knowledge and to key current thinking to the challenges of the future.

Austin W. Betts

A. W. BETTS
Brig. General, USA
Director,
Advanced Research Projects Agency

MISSION OF THE ADVANCED RESEARCH PROJECTS AGENCY

ARPA is a management device to lend emphasis to advanced military research and development. It's aim is to "leap-frog" the present state of the art and look far forward to dynamic concepts of United States defense in the space age.

It controls those projects which: (1) are too complicated to be identified with one military department; (2) are of interest to more than one military department; (3) can be better pursued by an agency not subordinated to military departments.

As the first step in development of a device or system, ARPA receives projects from the Director of Defense Research and Engineering. Once a system has been thoroughly explored and proven operationally feasible, it is reassigned by the Secretary of Defense to a particular military service for future development. Although ARPA is strictly in the research and development field, it does act in an advisory capacity to the command taking over a program but this is only to facilitate a smooth transition from the planning to the producing stages.

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DEPUTY DIRECTOR- Dr. John F. Kincaid

Scientific and engineering support by the Institute for Defense Analyses.

Studies, reports and technical assistance in (a) space science and technology, (b) ballistic missile defense, and (c) other advanced research and development as may be assigned, to include the following:

1. Research, analysis and experimentation, including systems, equipment, components and facilities.
2. Systems engineering.
3. Analysis and evaluation of scientific and technical capabilities for research and development to achieve military and scientific objectives.
4. Interpretation and evaluation of the scientific data derived from tests and experiments.
5. Development of new programs.
6. Surveys and analyses of the effectiveness of various proposals and systems.
7. Evaluation of new equipment in the light of DOD needs.
8. Evaluation and analyses of military problems to predict the operational behavior of new materiel and equipment.
9. Development of proposed new military opportunities to meet changing requirements.

FINANCIAL MANAGEMENT AND REPORTS DIVISION

DIRECTOR- W. W. Bolton

1. Prepares budget estimates and justifications; serves as focal point for all financial matters.

2. Converts technical proposals into workable management plans.

3. Arranges for the conduct of approved ARPA projects by DOD or other Government agencies, or private organizations.

4. Establishes, directs and maintains reporting system for ARPA, develops milestone schedules, performs program analysis, provides visual display of program status.

5. Conducts management studies to determine economy and efficiency of operations.

PROJECTS AGENCY

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- NATIONAL SCIENCE FOUNDATION
- NATIONAL ACADEMY OF SCIENCES
- OTHER GOVERNMENT DEPARTMENTS AND AGENCIES

TECHNICAL OPERATIONS DIVISION

DIRECTOR-N.E. Golovin

Manages approved projects, including day-to-day liaison with military departments, other Government agencies and contractors, as required.

Develops work assignments to IDA for studies, reports and technical assistance on continuing work projects under development by ARPA and works with Policy and Planning Division in the development of initial requirements.

Assists the Financial Management and Reports Division in the translation of approved technical proposals into workable management plans.

Recommends solution of major problems encountered.

Recommends re-direction, cancellation or consolidation of approved projects as necessary.

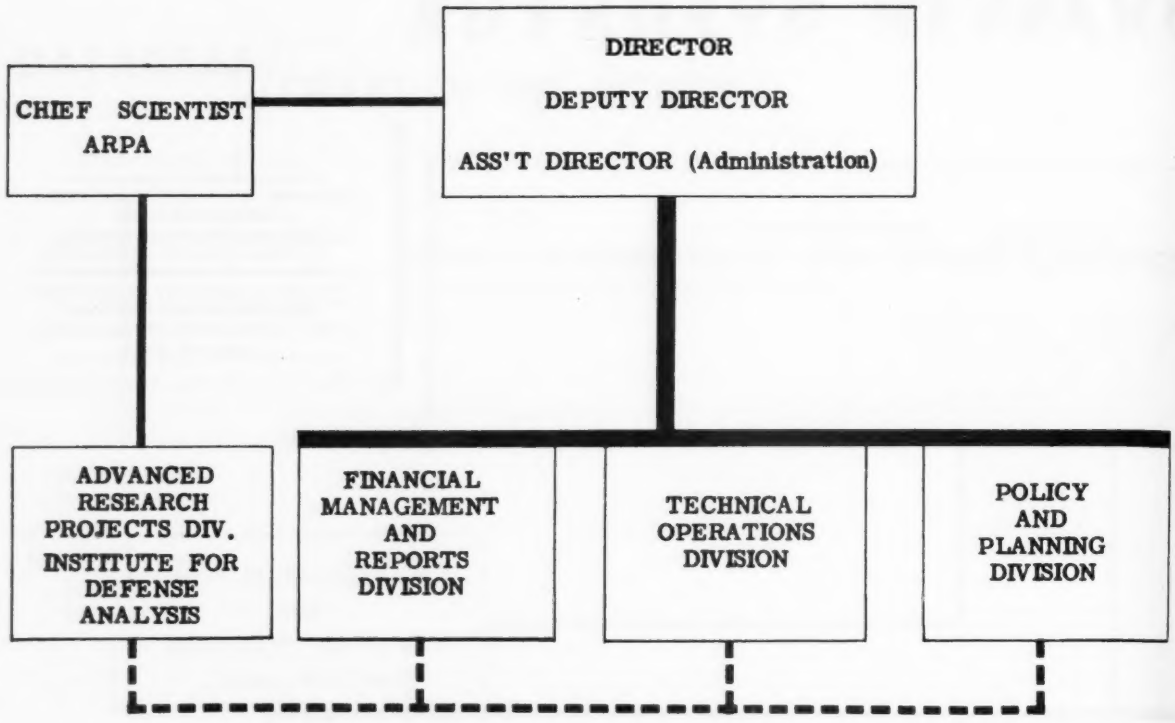
Facilitates transfer of completed research and development projects to the military departments assigned operational responsibility.

POLICY AND PLANNING DIVISION

DIRECTOR- W.H. Godel

1. Serves as focal point for all ARPA policy matters, including liaison with the NSC, OCB, NASC, CMLC, military departments, OSD and other Government agencies.
2. Monitors military requirements in research areas assigned to ARPA; participates on joint requirements panels; and recommends as to the validity and relative priority of stated requirements.
3. Develops long-range program goals to guide fiscal and technical planning.
4. Develops, in coordination with the Technical Operations Division, initial work assignments to IDA for studies, reports and technical assistance in research areas as assigned to ARPA.
5. Reviews project proposals for conformance with long-range goals; coordinates proposed projects within the DOD and with appropriate Government agencies.
6. Reviews, snythesizes and distributes significant technical-intelligence information on foreign scientific developments of interest to ARPA and arranges for acquisition of such data on request.
7. Identifies and arranges to exploit significant foreign scientific developments in areas of ARPA interest.
8. Maintains status of and prepares briefings, press releases, speeches on ARPA plans and programs, as required.

THE ADVANCED RESEARCH PROJECTS AGENCY



ORGANIZATION OF ARPA

The ARPA is a small line management agency of the department of Defense responsible to the Director of Defense Research and Engineering. Its management nucleus consists of fifty professional administrators and technical managers together with forty-five technical advisors from IDA. Technical proposals to ARPA are evaluated by the staff of IDA scientists in the light of presently available scientific knowledge. Should the IDA technical advisor determine that this proposal represents a creative increment to our current knowledge-inventory, he may recommend that ARPA sponsor this research. His findings are indorsed by the ARPA Chief Scientist, who serves doubly as the Director of the IDA Division. This indorsement is forwarded to the ARPA Program Counsel where the proposal is regarded not only from its scientific implications, but from other policy, legal and fiscal aspects as well.

The ARPA Policy and Planning Division analyzes the technical evaluation for its implications on long range planning, intelligence, public and legislative relations, and other policy considerations. The ARPA Technical Operations Division, which will be charged with managing this proposal, ascertains whether it may be translated into a workable management plan. The Financial Management and Reports Division assesses the financial resources available to support this research. The Assistant General Counsel of the Department of Defense also advises on its legal aspects.

With the approval of the ARPA Program Counsel, the proposal is then forwarded to the ARPA Director for final decision and approval. Following approval, the FM&R Division issues an "ARPA Work Order" (technical management outlines and transfer of financial resources) to a military service or other governmental agency who will serve as the ARPA agent to the contractor directly.

At the same time the work order is drawn up, a project manager is assigned in the Technical Operations Division to follow the program and provide day-to-day technical guidance and instructions.

Despite this apparently involved procedure, the "technical evaluation to ARPA Order" procedure can be accomplished normally in but a week's period. ARPA is a swift management unit, the Agency is such a small unit.

In these three ways: fiscal, control, responsibility for first echelon decision-making, and detailed, accurate reports, ARPA keeps tabs on projects with only a small staff.

GENERAL INFORMATION ABOUT IDA, ARPA INTERESTS, AND PROPOSALS TO ARPA

INSTITUTE FOR DEFENSE ANALYSES

At the invitation of the Secretary of Defense, five universities joined together in 1956 to form the Institute for Defense Analysis. This organization was created to fulfill a need foreseen by the 1955 Hoover Commission and other management groups to encourage a close working relationship between the science community and the National Defense establishment.

These five universities were California Institute of Technology, Case Institute, M.I.T., Stanford University. and Tulane University. Working with other university and national leaders, they pooled their knowledge as an advisory group chiefly to support the Weapons Systems Evaluation Group of the Department of Defense.

In 1958, IDA undertook technical support to ARPA under a contract with the Secretary of Defense. After the high urgency conditions created by Sputnik I, IDA collected an initial professional staff by borrowing heavily, on a leave-of-absence basis, among key technical personnel of industry, private research groups and universities. This "borrowed" staff has been gradually supplemented by permanent staff employees.

IDA's objectives are: to provide the means by which scientists, engineers, and other professional people—especially university people—may most effectively apply their talents to government problems in a way that will not tax university resources, and to spread an awareness in the academic community for the pressing problems of national security.

Future plans foresee an increased proportion of time to be spent by IDA on longer range aspects of current defense problems.

ARPA FIELDS OF INTEREST

The five main fields of current ARPA interest are Ballistic Missile Defense, Solid Propellant Chemistry, Materials Research, Advanced Exploratory Research, and research associated with the nuclear test moritorium. Ballistic Missile Defense is directed towards ascertaining ballistic missile defense techniques beyond the current Nike-Zeus and BMEWS systems. This DEFENDER project involves such varying disciplines as interception, anti-satellite techniques, radar and ranges, kill mechanisms, discrimination, data processing, and upper atmosphere physics.

Solid Propellant Chemistry (Project PRINCIPIA), aims to enhance the specific impulse of currently available solid fuels by ten to twenty percent. The materials program (Project PONTOS) is largely a university orientated research program leading to improved ceramic, metalurgical and other critical materials.

The Advanced Research Projects Agency is still engaged in several "hardware" programs in the space technology field rather than truly advanced research. These programs such as communications, navigation, and tracking may be transferred to the military services in the very near future. Advanced Research Projects Agency is also engaged in Advanced Exploratory Research (Project LONGSIGHT), which is mostly longrange feasibility studies in the space environment.

Project VELA was the recently announced program of research associated with the nuclear test moritorium.

The Agency encourages unsolicited proposals in any of the above fields. It must be remembered; however, that ARPA is designed to handle radical, new concepts. Routine modifications and developments should be submitted to the three services.

HOW TO SUBMIT PROPOSAL TO ARPA

Before submitting an unsolicited proposal to ARPA, a thorough search should be made of all technical reports, and authorative publications to ensure that the proposal is directed beyond the present state of the scientific art. Proposals should then be submitted in duplicate to the Director, Advanced Research Projects Agency, Room 3E-183, The Pentagon, Washington 25, D. C.

Although no standard format exists, it is recommended that proposals be no more than 25 pages long and that a differentiation be made between proprietary data and patent data.

The following points should be included: general statement requesting consideration of the proposal; technical description of the proposed work including a brief review of the scientific background and of work previously done in the field; statements of objectives of the project; technical approaches proposed; special facilities and equipment required and available; estimated cost of proposal including breakdown; names and backgrounds of principal scientists and engineers who will be engaged in the project.

THE RECENT CHANGE-OVER IN ARPA

MR. LAWRENCE P. GISE
Director for Administration of the Advanced Research Projects Agency

Lawrence P. Gise is a career civil servant who entered Federal Service in 1935. At the advent of WWII, he entered the Navy as an Ensign. Four years later after serving with distinction as a gunnery officer aboard a Destroyer Escort during the war, Lt. Commander Gise was released from active duty. He returned to civil service and entered the Atomic Energy Commission soon after its formulation where he became the Assistant Director of the Division of Military Applications. This division of AEC has responsibility for the development and production of atomic weapons. Mr. Gise served the AEC from 1949 until 1957 when he came to ARPA.

Lawrence Gise is married and has a 23-year-old son who is a Lieut. (jg) in the Navy and a 13-year-old daughter. A native of Laredo, Texas, Lawrence P. Gise likes woodworking, hunting and fishing when he is not tied up with the problems of the Advanced Research Projects Agency.

An Interview with Lawrence P. Gise, Assistant Director for Administration of the Advanced Research Projects Agency, as told to Murray Queen Smith, publisher of DATA.

Q. Mr. Gise, is ARPA a permanent organization?

A. Well, permanent is a pretty big word; however, I am convinced, and so are many others acquainted with the problem, that an ARPA-type organization at the Secretary of Defense level will be needed for some time to come.

Q. Could you explain briefly how ARPA is organized?

A. I would be glad to. ARPA is a small management organization with responsibility to carry out research on selected projects assigned to us from time to time by the Secretary upon the recommendation of the Director of Defense Research and Engineering. These project assignments fall into three general categories: (1) research not identified with a specific military requirement; (2) research which relates to the primary function of two or more of the military services; or (3) research which for other reasons is better handled by an agency other than one of the military services. Funds to carry out these projects are made available directly to ARPA by the Congress and in some cases by transfer from service appropriations. Under a contract with the Institute for Defense Analyses, a non-profit corporation, we receive expert scientific advice in planning and evaluating the technical phases of our projects. Most of our projects are contracted by an existing field agency of one of the military departments acting as our agent. Day-to-day guidance to our agent and the contractors is furnished by a project manager in our Technical Operations Division.

Q. At what point does ARPA transfer responsibility for its projects to the military departments?

A. It is intended that ARPA control a project only to the point of demonstrating feasibility of the concept. Once this point is reached the project will be turned over to one of the military departments for development as a weapons system or as an adjunct to the weapons system.

Q. What is the significance of the recent announcement that ARPA was getting out of the space business?

A. ARPA's assignment in the space field has been a transitional one. Space technology was one of ARPA's major assignments at the time it was established in Feb. 1958. The following October, with the creation of NASA, all of the non-military projects were transferred to the new agency. Within the last few months the Secretary announced a plan whereby the major military space projects will be transferred to the military departments. *Under this plan the Air Force will be responsible for launching all satellites required by the DoD.* Satellites themselves, or payloads, will become the responsibility of selected military departments but will serve the needs of the entire defense establishment. *Under the plan the Air Force will be given responsibility for reconnaissance and early warning satellite systems, the Army responsibility for communications satellites and the Navy responsibility for navigation satellites.*

Q. How does the recent announcement with respect to the SATURN booster fit into all of this?

A. Well, the SATURN booster was an exception to the decision to transfer all non-military space activities to NASA when that organization came into existence in October of last year. The reason for the exception was that SATURN has always been an in-house effort at ABMA and for this reason it made little sense to separate the management of the project. There was some discussion as to the desirability at that time of transferring ABMA to NASA along with the SATURN project. However, ABMA was heavily committed on a number of high priority Army projects. During the past year the situation at ABMA has changed considerably and the SATURN booster is now their major effort. In view of the change the President has stated that he will recommend to Congress that ABMA and the SATURN booster be transferred to NASA. Until this transfer takes place the project will continue to be managed by ARPA.

Q. With all of these transfers what projects will remain with ARPA?

A. The transfers we have been discussing are all in the space area. In the non-space field our largest project is known as DEFENDER which deals with advanced research in ballistic missile defense. This project, which is aimed at systems beyond the NIKE-ZEUS, involves expenditures aggregating $100 million a year looking into all possible methods of identifying and destroying enemy ICBMs. One example in this field is our GLIPAR program.

Q. Mr. Gise, could you tell our readers just what is GLIPAR?

A. The name stands for Guideline Identification Program for Anti-Missile Research. The project

deals with probable missile defense systems that will be needed 10 to 20 years hence. For the past six months 12 contractors have been engaged in independent studies in this area. Starting in January these contractors are being brought together at the Presidio near San Francisco as a winter study group to explain and compare the results of their research. Included are: Convair, Aeronutronic Systems, Allied Research Associates, the University of Chicago, General Electric Tempo, General Mills, Hughes Aircraft, Industrial Research Associates, Ramo-Wooldridge, RCA, Republic Aviation, and Tech Operations Inc.

Q. And what are the other projects?

A. Another project which we have as an active program concerns itself with solid propellant research through which we hope to achieve an increase in specific impulse of from 10 to 20 percent. Still another is basic research on materials. Under this project we have plans to establish interdisciplinary laboratories at four or five universities to concentrate on this important area.

Q. Can you hazard any guesses as to future ARPA assignments?

A. I would rather not. There certainly will be other assignments from time to time. The specific areas will be determined by the Director of Defense Research & Engineering as he reviews the over-all Defense research and development program. To be eligible for assignment to ARPA he must be convinced that the project should be centrally managed and that ARPA with its unique capabilities can do the job more effectively than through its assignment to one of the military departments.

Q. How will this affect ARPA budget-wise?

A. We will have a smaller budget but still one of fairly large proportions for a research organization.

Q. Is there anything, Mr. Gise, you'd like to tell our readers in conclusion?

A. I would like to wish your readers a happy and prosperous New Year and to tell them that ARPA is most receptive of any new ideas in the fields of our assigned interests.

ARPA

PERSONNEL DIRECTORY

15 DECEMBER 1959

All offices shown are in Pentagon. First number is room, Second is phone extension. OX is prefix if dialing from outside.

DIRECTOR'S OFFICE

B/Gen. Austin W. Betts	3E160	78255
Erma Flores	3E160	78255

DEP. DIRECTOR'S OFFICE

M/Gen. Don Ostrander (leaving)	3E172	57151
Elvira Haas	3E172	57152

ASST. DIRECTOR'S OFFICE

L. P. Gise	3E172	57167
Sadie Kennedy	3E172	57168

CHIEF SCIENTIST'S OFFICE

George P. Sutton	3E160	57105
Peggy McVearry	3E160	57106

ARPA ADMINISTRATIVE OFFICE

John E. Lynch	3E183	57061
Joyce Via	3E183	57061
Carleen Brown	3E183	57062
SP5 David C. Wobb	3E183	57062

FINANCIAL MANAGEMENT & REPORTS DIVISION

W. W. Bolton, Jr.	3E189	57073
Julia Palieri	3E189	57073
Margo Walcavich	3E189	57073
Carroll Austin	3E189	57074
Donald Hess	3E188	57074
Robert Gilliat	3E189	57074
Gerry Sheets	3E189	57074
Russell Beard	3E189	57071
Bernard Korenblit	3E189	57072
Joyce Webb	3E189	57072
Mary Edwards (eff. 10/19/59)	3E189	57072

POLICY & PLANNING DIVISION

William H. Godel	3E169	57100
Ruth Hudgins	3E169	57044
Rand Araskog	3E178	77426
Leona Follin	3E178	77426
Col. T. Brundage	3E169	57193
Josie Valenti	3E169	57194
Lambert Lind	3E177	57068
Col. W. Sturges	3E177	57069
Daniel Sullivan	3E169	57193
Lt. Col. C. Young	3E177	57069
Lee Huff	3E177	57068
Capt. C. Styer	3E169	57194
Don Helm	3E178	77426
JoEllen Long	3E177	57069
Ronnie Purviance	3E177	57068
Betty Martinson	3E177	57068

TECHNICAL OPERATIONS DIVISION

Dr. N. Golovin	3E161	79305
Shirley Callen	3E161	79306
Col. Dent Lay	3E161	57195
Mary E. MacDonald	3E161	57196

Satellite Branch

Edw. E. Harriman	3D170	57087
Lt. Col. P. Nadler	3D170	57046
Cdr. Charles J. Burton		
Theodore George	3D170	57047
Maj. John A. Paulson	3D170	57047
Helen Shrout	3D170	57087
Julie Gorman	3D170	57047
Pat Harmon	3D170	57046

Missile Engine & Propellant Branch

Carlton Beyer	3D160	73455
Col. R. Thomas	3D160	73495
Cdr. Robert Luker	3D160	76875
Capt. F. Maxwell	3D160	76875
Lt. Col. E. Tavasti	3D160	76875
Barbara Givens	3D160	73455
Pat Crawford	3D160	73495
Ruth Herms	3D160	76875
Dorothy Crowe	3D160	73495

Communications & Tracking Branch

Paul Price	2B257	79073
James Spriggs	2B257	77687
Cdr. David Holmes	2B257	77687
Lt. Col. E. Wright	2B257	77531
Capt. W. Snead	2B257	79075
Grady C. Frank	2B257	77531
Fran Parker	2B257	79073
Pat Clingan	2B257	77619
Phyllis Wireman	2B257	77619

Ballistic Missile Defense Research Branch

Dr. John Ide	2B260	52749
Cdr. Don E. Chandler	2B257	79488
Lt. Col. R. Weidler	2B257	79488
Capt. P. J. Kenny	2B257	79488
Margaret Adams	2B257	78997

Ballistic Missile Defense Engineering Branch

A. Rubenstein	2B260	52984
Richard Lilly, Jr.		
Lt. Col. W. Sydnor	2B257	79075
Lt. Col. Kenneth Cooper	2B257	78997
Vivian Bullock	2B260	52749
Lee Perse	2B257	78997
Lt. Col. Henry Clanton		

Special Projects Branch

Ray E. Adcock	3D186	57060
William Koehler	3D186	57060
Col. Charles Ruzek	3D186	57060
Secretary	3D186	57059

Exploratory Research & Reliability Branch

Landis S. Gephart		
Emanual Haynes		
Catherine D. Hock	3D170	57055

INSTITUTE FOR DEFENSE ANALYSES

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15 December 1959

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Hoyt, F. C. 3D154 57026
Irvine, C. R. 3E153 52673
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Donohue, R. 2B260 52316
Edwards, W. 2B260 79315
Grobecker, A. J. 2B257 79401
Iddings, H. G. 2B257 79485
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Mitcham, G. 2B260 54120
Von Handel, P. 2B257 79949
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Heeter, Shirley 2B257 79485
Murray, Jane 2B257 79401
Williams, Jerrilee 2B260 54120
Woody, Betty Jo 2B257 79949

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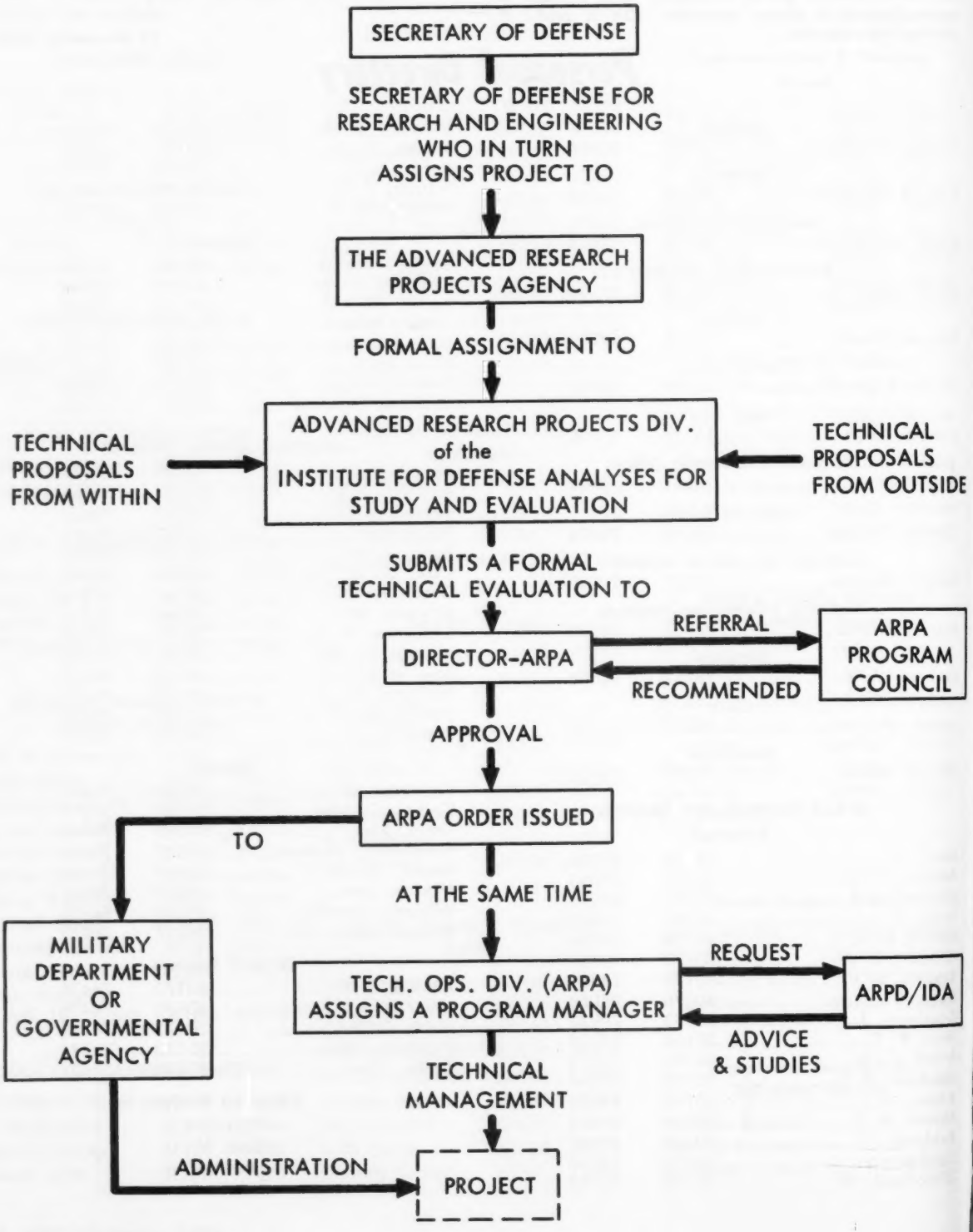
May, W. 3D173 74476
Mock, G. V. 3D173 74484
Piombino, Helen 3D173 74476
Curtis, June 3D173 74484

Advanced Analysis

Cutchis, P.
Gore, M.
Sawitz, P.
Tyaack, F.

FLOW CHART SHOWING MOVEMENT OF A TYPICAL ARPA PROJECT



A Review of

ARPA ACTIVITY in 1959

KEY TO ABBREVIATIONS

AOMC – Army Ordnance Missile Command
ARDC – Air Research and Development Command
NOTS – Naval Ordnance Test Station
NASA – National Aeronautics and Space Administration
ONR – Office of Naval Research
NRL – Naval Research Laboratory
BRL – Ballistic Research Laboratory (Aberdeen Proving Ground-Army)
NBS – National Bureau of Standards (Dept. of Commerce)
BuOrd – Bureau of Ordnance (Navy)
OOR – Office of Ordnance Research (Army)
BuAer – Bureau of Aeronautics (Navy)
BuMines – Bureau of Mines (Dept. of Interior)
ASC – Army Signal Corps
NOL – Naval Ordnance Laboratory
PMTR – Pacific Missile Test Range

Description of Work	Participating Gov't Agency	Principal Contracts Awarded or being Negotiated	1959 Funds Appropriated (In Thousands)
Civilian Space Programs – Transferred to NASA			
2 lunar probes; cosmic ray experiment; 12 ft sphere	AOMC	Transferred to NASA	$18,820
3 lunar probes	ARDC	Transferred to NASA	7,600
Ground scanning for lunar probes	NOTS	Transferred to NASA	400
Meteorological payload	ASC	RCA	6,711
Military Space Technology Satellite Systems			
DISCOVERER	Sec/AF	Lockheed	106,000
MIDAS	ARDC	Lockheed	10,800
SCORE	ARDC & ASC	Convair	704
SENTRY	Sec/AF	Lockheed	96,600
Delayed repeater system (COURIER)	ASC	(Primarily in-House)	3,000
Doppler navigation system (TRANSIT)	BuOrd	Johns Hopkins. Lockheed	1,383
Subsystems for meteorological project	ARDC		1,151
Launch vehicles	ARDC	Douglas	18,300
Active repeater communication satellite (launch & control)	ARDC		1,000
Active repeater communication satellite (payload)	ASC		1,000

Description of Work	Participating Gov't Agency	Principal Contracts Awarded or being Negotiated	1959 Funds Appropriated (In Thousands)
Propulsion & Launch Facilities			
SATURN	AOMC	In-house with engines from Rocketdyne	24,508
CENTAUR	ARDC	Convair; Pratt & Whitney	16,000
Static Test Tower & Launch Stand construction (SATURN)	AOMC		9,492
Large thrust test stand, EAFB (1 million lb. thrust single chamber engine)	ARDC		240
Tracking & Ground Environment			
SPACETRACK	ARDC	(Primarily In-house)	1,299
JPL ground space surveillance	AOMC	JPL	226
Spain & Japan tracking installations	ASC		7,601
Instrumentation ship PVT. JOE E. MANN (PMTR)	ARDC	Philco	1,100
2 VC-2 vessels (PMTR)	BuAer		2,300
Minitrack modifications and extensions	NRL	(Primarily In-house)	11,740
Doppler system installation	BRL	(Primarily In-house)	6,875
Exploratory Research			
Stagnation point ballistics	Army R&D	Metallbau Semler, Munich, Germany	290
Properties of materials at low temperatures	NBS	In-house	184
Nine studies in space power research	ASC		961
Study in space power research	BuShips		200
Research in high temperatures and pressures	NOL	Bjorksten Research	115
Feasibility Studies (space propulsion and power sources)	ONR	Princeton Univ.; Curtiss-Wright Republic Aviation; Univ. of Calif.	413
Feasibility studies (Project ORION, Adv. space propulsion & power sources)	ARDC	General Atomic; Aerojet; Reaction Motors; Plasmadyne; Experiment, Inc.; Aeroneutronic; Atlantic Research Corp.; AVCO; Rocketdyne; Fairchild Aircraft; Aero-Chem Research; Vidya Associates; RCA	2,809
Feasibility studies (Heat rejection from space vehicles, advanced power sources)	AOMC	Electro-Optical	182
Magnus effect study	BuAer	Flettner Aircraft	28
Plasma electron study	Army R&D	Batelle Memorial Institute, Frankfurt, Germany	307
Ballistic Missile Defense (Project DEFENDER)			
Info. center on high altitude weapons effects	ARDC	Rand Corp.	144
Re-entry physics studies	ARDC	Mass. Inst. of Tech.	4,646
Omni-Range Digital Radar	ARDC	Columbia University	1,328
Electronically Steerable Array Radar	ARDC	Bendix Aviation	2,144
Missile Range measurements	ARDC	(Primarily In-house)	3,435
ACANIA assignment to AMTR	ARDC	Stanford Research Inst.	575
H.F. ionospheric radar research	ONR	(Primarily In-house)	535
Ballistic missile defense system studies	ARDC	Convair	1,375
Atmospheric and ionization studies	ARDC	A.D. Little; Convair	1,435
Radar discrimination	ARDC	Raytheon	680

DATAGRAM

AIR & SPACE

NASA TO LAUNCH 100 FT. SPHERE - PROJECT ECHO

Early next spring, NASA will launch 100 ft. aluminum-coated sphere into 1000 mi. altitude earth orbit. Purpose: to test feasibility of passive reflector communications system. NASA hopes to estab. 2-way radio communications bet. East and West Coasts of U.S. by bouncing signals off the sphere. Such satellites may one day be used as relay stations for transmission of signals, voice, and television. ///NASA/

AF REORIENTATES B-70 BOMBER PROGRAM

AF is reorientating B-70 bomber program to prototype aircraft looking to first flight in 1963. Although $60 million has already been spent, contracts for Bomb-Navigation System (IBM), Defensive Subsystem (Westinghouse), and Traffic Control (Motorola) will be terminated. Major subcontracts for airframe will be returned to North Amer. Inglewood plant. ///Dept. of Defense/

PHANTOM II JET SETS ALTITUDE RECORD

Commander L. E. Flint, USN, set new world record for altitude for aircraft on Dec. 6, 1959, when McDonnell F4H Phantom II carrier jet soared to 98,560 ft. This bettered current record of 94,658 ft. set in July by Major Ilyushin of USSR. ///Dept. of Defense/

FAULTY ENGINES DISCOVERED BY OIL TEST

Navy has announced a test for evaluating condition of aircraft engines thereby preventing in-flight failure. A one-ounce sample of engine oil is burned between 2 carbon electrodes in a direct-reading spectrometer which identifies the metals present and indicates their quantity. High concentration of silver indicates faulty bearing; chromium: cylinder wall damage; aluminum: piston or valve guide failures. ///Bu Weapons/

AEROCAR GEARED FOR DUAL TRANSPORTATION

In 1960, if licensing negotiations are successful, Aerocar, Inc., Longview, Washington, will begin production of a 2-place vehicle that converts from a car to an airplane in a matter of minutes. Cruising speed for the plane is 100 mph; on landing, the wings can be folded back onto a built-in trailer and the vehicle can be driven as a car at a practical road speed of 55-60 mph. ///Aerocar/

CONFLICT ON CENTAUR BETWEEN USAF AND NASA

There is some difference of opinion between USAF and NASA as to who should have control of the CENTAUR hydrogen-powered upper stage vehicle which is designed for launching communications satellites for SAC purposes. Formerly under ARPA, project went to NASA in July. ///NASA/

ATOMIC ENERGY

NAA TO BUILD CRITICAL EXPERIMENTS FACILITY

AEC will issue permit to North Amer. Aviation to build critical experiments facility in Ventura, Calif. To be used for investigation of characteristics and nuclear properties of fast neutron energy systems. ///AEC/

BIOMEDICAL RESEARCH FACILITY TO BE BUILT IN MD.

Biomedical research facility designed exclusively for radiation research will be built at Navy Medical Center, Bethesda, Md. ///Dept. of Defense/

RECIPROCAL EXCHANGE ON PEACEFUL USES OF ATOMIC ENERGY

U.S. and USSR have signed memorandum providing for program of reciprocal exchange in field of peaceful uses of atomic energy. Agreement makes general provision for exchanges of unclassified information and visits of scientists to unclassified areas, and for the exploration of desirability of unclassified projects jointly sponsored. ///AEC/

COMMUNICATIONS / ELECTRONICS

BENDIX DEVELOPS NAVIGATIONAL SATELLITE FOR COMMERCIAL USE

Navigational satellite for commercial use has been built by Bendix with a price tag of $1,000 to $2,000 with the thought of selling them for use on merchant ships and aircraft. ///Bendix/

TUNNEL DIODE RELEASED BY RCA

RCA made its new germanium tunnel diode (see DATA, Nov., 1959) available to industry at a cost from $50 to $140. Diodes are designed for operation up to 1,000 mc with power consumption ranging from 0.75 mw to 3 mw. The pn junction is 1/1000-inch in diameter and 80 angstroms wide, mounted in a miniature low inductance ceramic case. ///Electronic News/

TEST CHAMBER SIMULATES IONOSPHERE

High-altitude test chamber that duplicates conditions met by missiles and satellites 100 miles above earth is now in use at Fort Monmouth, N. J. ///Army Info/

Atmospheric pressure in chamber can be reduced to simulate the virtually air-free environment of the ionosphere and temps can be varied from 90 degrees F. below 0 to 300 degrees above. Used to test operating stability of equipment and components. ///Signal R & D Lab/

LOGISTICS/MATERIALS

SOLUTION FOR PRODUCTION OF DIFFICULT CONTOURS

Northrop Corp's Norair Div. has developed a system of chemically milling honeycomb structures for production of difficult contours such as inside double curvatures. The cost, as compared with same units produced under the machined and crushed methods, is cut by more than half. For complete info, see Aviation Week, 11/16/59, p. 92.
///Aviation Week/

DEMOUNTABLE HOUSEHOLD GOODS CONTAINERS

Navy is using demountable wooden moving containers which can be assembled quicker and last longer than old-type. To be used primarily in transportation of household goods, the boxes are bound together with pieces of steel strap that, instead of having to be bolted, fit into raised slots in steel plates. ///Bu Sand A/

PROTECTIVE COATING FOR POLISHED SURFACES

Zincilate WST-100 is a new , scratch-resistant, temporary coating for the protection of polished surfaces such as metal, glass, and many plastics. Easily removed with warm water, the coating is non-flammable, withstands forming and bending, non-reactive, etc. and air dries in 30 min. Complete info may be obtained from Industrial Metal Protectives, Inc., 401 Homestead Ave., Dayton 8, Ohio.
///Missiles and Rockets/

TANK COATINGS

One of the latest methods of protecting the steelwork of cargo oil is by the use of epoxy resin paints. One of the coatings that has been used successfully for more than three yrs. is Colturiet, an epikote-based tank lining made by Bettewinkel & Zonen N.V., Amsterdam. See Nov. 4 issue of Shipping World. ///Shipping World/

CERAMIC TUBING RESISTS SHOCK, HIGH TEMPS

Beryllium oxide ceramic tubing in lengths up to 24 in., is available from National Beryllia Corp. It is valuable for use at extremely high temps where heavy radiation is involved; greater strength than any known ceramic above 2000 degrees F., high electrical resistivity, dust-free, gas-tight, etc. ///Missiles and Rockets 11/16/59/

NEW METAL WITHSTANDS HIGH TEMPS

Army has dvlpd rare metal, gallium phosphide, which will withstand temps up to 1500 degrees (F.). Metal is especially valuable in electronic work because of conductivity and resistance properties. ///Army Info/

AIR FORCE ASKS BIDS ON SOLID PROPELLANT ROCKET

Air Force has asked for bids on solid propellant rocket that would produce a million lb. thrust. Because proposal omits any mention of potential applications and substitutes the total impulse figure for a specific total thrust requirement, the AF program is distinct from NASA's. It is believed that the company that gets this contract will have a substantial competitive edge in the future development of large solid propellant rocket engines. ///ARDC/

LIGHT, LOW-COST TURBINE

Williams Research Corp., Walled Lake, Mich., has developed a low-cost 75 mph, 75 lb. regenerative gas turbine that may have applications for light aircraft. For certain military applications, such as lightweight helicopters, a non-regenerative version will be available that weighs only about 50 lb. A test installation, mounted as an outboard motor in an 18 ft. Thompson boat, has been running for 15 mos. ///Williams Research/

DEADLINE DATA

CONTRACT FOR SHILLELAGH PROGRAM AWARDED TO FORD

Aeronutronics Division of Ford has been awarded an $8,617,624 contract for SHILLELAGH program. SHILLELAGH is a new light-weight surface-to-surface guided missile system for close-in support of troops. ///Army Info/

PROJECT VELA ASSIGNED TO ARPA

PROJECT VELA, a research, experimentation, and systems development system related to the nuclear test moratorium, has been assigned to ARPA. ///DATA/

BIDS INVITED ON MARINER CLASS SHIPS

J. R. Dant, president of States Steamship Co. has announced that bids are open for 4 Mariner-class ships scheduled for completion in 1962. ///N. Y. Journal of Commerce/

IMPROVED SUBMERSIBLE ANTI-MAGNETIC WRIST WATCH

Bulova has developed wrist watch for Navy that is submersible, pressure-tight to depths of 400 ft., absolutely nonmagnetic, with luminous dials and a rotatable bezel which can be set to indicate elapsed time up to a period of 1 hr. Movements will not reaily corrode. Winding stem is exposed for setting or winding. ///Bu Ships/

Description of Work	Participating Gov't Agency	Principal Contracts Awarded or being Negotiated	1959 Funds Appropriated (In Thousands)
Down range ship operation	AOMC	RCA	2,700
High power radar research	AOMC	Cornell Aero Lab.	1,361
Advanced radar research	ARDC	Mass. Inst. of Tech.; Lincoln Lab.	515
Vertical probe launching	ARDC	(In-house)	397
Decoy sorting radar	ARDC	Raytheon Corp.	1,180
Microwave radar	ARDC	RCA	850
Artificial electron clouds study	ASC	Itek Corp.	39
Catalytic effects in discharges	BRL	(In-house)	80
Design of hypersonic intercept system	ARDC	Convair	1,033
Hypervelocity impact research	NRL	(In-house)	525
Hypervelocity impact research	BRL	(In-house)	300
Photodetachment cross-section studies	NBS	(In-house)	30
Digital phased array radar	AOMC	Sylvania	1,434
Transmission of ion and atomic beam studies	ASC	American Machine & Foundry	100
Feasibility Studies (Primarily GLIPAR)	ONR	Gen. Atomic, Div. of Gen. Dynamics Stanford Research Inst.; Westinghouse Aeroneutronic Systems, Inc.; Allied Research Associates; Univ. of Chicago Convair; General Electric Tempo; General Mills, Inc.; Hughes Aircraft; Industrial Research Asso.; Ramo-Wooldridge; RCA; Republic Aviation; Technical Operations	1,780
Feasibility studies (satellite defense systems, missile phenomenology)	ARDC	RCA; Convair; General Electric; Lockheed; Gen. Atomic; Republic Aircraft; Dikewood Corp.; Allied Research	3,805
Feasibility studies (Space intercept, re-entry, and target studies)	AOMC	Solar Aircraft; Bendix Aviation; AVCO Research; Raytheon; Convair	3,257
Solid Propellant Technology			
Studies of light element compounds	NBS	(In-house)	500
Solid propellant research	BuOrd	Minnesota Mining; American Cyanamid; Aeroneutronics; Applied Physics Lab.; Magna Propulsion; Atlantic Research Corp.; Olin Mathieson; New York Univ.; Navy (In-house); Allegany Ballistics Lab. (In-house); NOTS, NOL (In-house)	5,201
Solid propellant research	ONR	Ohio State Univ.; Princeton Univ.; Aerojet; Aerochemical Research; Univ. of Calif.; Polytechnic Inst. of Brooklyn; Penn State Univ.	700
Solid propellant research	ARDC	Dow Chemical; Gallery Chemical; Monsanto Chemical; Pennsalt; Borden; Penninsular Chemresearch; Ethyl Corp.; Atlantic Research Corp.; National Research Corp.; Univ. of Texas; Stanford Research Institute; Aerojet; Univ. of California; Materials Research Corp.; Materials Laboratory, WADC (In-house); Air Force (In-house)	3,910
Solid propellant research	AOMC	Esso Research & Engineering; Allied Chemical; Olin Mathieson; Army (In-house); Rohm & Haas (In-house)	3,267
Solid propellant research	OOR	Univ. of Chicago; Duke Univ.; A.D. Little; Vanderbilt Univ.; Univ. of Florida	630
Solid propellant research	BuMines	(In-house)	215

ARPA Funding

OUTLOOK FOR 1960 . . .

(Dollars in Millions)

Project or Category	1960 Estimate
SAMOS — Reconnaissance	$150*
DISCOVERER — Vehicle Development	65*
MIDAS — Early Warning	47*
TRANSIT — Navigation	11
NOTUS — Communication	36
TRIBE — Vehicle Development	75
SHEPHERD — Tracking	12
LONGSIGHT — Feasibility Studies	12
DEFENDER — Missile Defense	100
PRINCIPIA — Propellant Chemistry	17
TOTAL	$525

* Transferred to the Air Force

Additional funds for **PONTUS** (Materials) and **VELA** are under consideration.

The 1961 Budget, as received by the Director of Defense Research and Engineering, is approximately $150 million and includes Projects Defender, Principia, and Pontus, with the Vela Project under consideration.

ARPA SPEAKS OUT ABOUT ITS REORIENTATION

An Editorial on Recent Happenings and ARPA Mission Changes

by John Lynch, ARPA Administrative Officer

The Advanced Research Projects Agency was created in the post Sputnik excitement. It was inevitable that ARPA would be termed the "Military Space Agency" even when the horizons forseen for the new Agency were far wider. ARPA was to encourage new ideas, new knowledge, and new discoveries, not merely new devices.

For nearly the first two years of its operations, ARPA was the centralized manager of the military space program, which involved a strong flavor on developmental hardware. This space hardware orientation competed also with the initial ARPA mission of truly advanced research.

Acting in part on the recommendations of the Agency, the Secretary of Defense announced in September 1959, his intentions to transfer several projects to the military service departments for operational development.

To date, projects SAMOS (reconnaissance), MIDAS (very early warning), and DISCOVERER (orbital recovery) have been transferred to the Department of the Air Force. The communications satellite is planned for eventual transfer to the Army and the navigation satellite (Project TRANSIT) to the Navy.

Aside from the field of exploratory research, the Advanced Research Projects Agency has transferred its role in booster development, instrumentation, and other military space technology to the Air Force.

ARPA will continue with its responsibilities for advanced ballistic missile defense, solid propellant chemistry, and materials research. The newly announced Project VELA research associated with the nuclear test moratorium, is an example of new research that requires the centralized management of an ARPA organization.

The Advanced Research Projects Agency is not limited by a Gresham's Law which distracts attention from the elusive soft monies of advanced research to the "hard-money" decisions on present day hardware. ARPA is free to concentrate on the long range needs for knowledge which will enrich our national security posture.

Feature Editorial

DATA/ARPA Issue

A CASE OF CONSCIENCE?

An Editorial on ARPA's Recent "Reorientation"
by Martin Caidin/DATA

The first stepchild of the space age seems rapidly on its way out the nearest and most convenient exit; convenience being merely the covering phraseology for official embarrassment at having a dead cat hanging in the front closet. ARPA—a creation of the wild furor in official Washington and the Pentagon after the shock of the first Russian satellites—was established specifically as a hurry-up measure to give the American space program a desperately needed shot of adrenalin. As such, ARPA heralded its birth with some truly sweeping powers; it was, in point of fact, the nation's prime space agency, and *its newborn status ranked ARPA equally with the three military services.* Because the ARPA Director was answerable only directly to the Secretary of Defense, there was an accepted belief that with the military missile program ready to throw its hardware into a space effort, it wouldn't be too long before American space muscle could be visibly flexed with some solid accomplishments.

Unhappily, this never came to pass. The consistent attitude of the White House that this nation is not, never has been, and will not be in a "race" with the Soviets in regard to astronautics, doomed ARPA almost after its conception. NASA, which we believed to be responsible for carrying the so-called civilian responsibility for efforts in the VANGUARD realm, gained strength almost steadily, and responsibility imparted to NASA soon began to shoulder ARPA out of the lead position. This occurrence, gaining a tremendous support from a determined military attitude to get ARPA the hell out of the way so that each individual service might retain its own management and control in major projects, sounded all too clearly the final death knell.

And in the opinion of at least this writer, this is a damned shame. There's no criticism implied of the people who are running NASA; Keith Glennan is doing a tremendous job, and a far better one than anyone would have bet early in the game. He brings to a major government agency that wonderful, all-too-rare element of candor, and right now stands to be remembered for a tremendously difficult task well fulfilled.

Yet, I can't help feeling that with the imperativeness of military necessity backing an ARPA undisputed as the major space agency, we wouldn't be in the appropriations sinkhole that NASA is now struggling through. As good as NASA may be, it doesn't carry the air of a vital military project. This fantastic insistence of the White House that we must avoid military taint in our major space effort defies all comprehension, but it's there. There isn't any race for space, true enough; but only because this nation has simply refused to accept a challenge not only the Russians, but the march of events, has hurled in our national face.

And why this grudging reluctance simply to wipe ARPA out of the picture in one swoop, rather than the slow bleeding of the organization? A case of conscience, perhaps? There's no question but that ARPA now lives on borrowed time. *It has been downgraded in status until ARPA now reports to the Pentagon R&E Chief, Dr. Herbert York, rather than to the Secretary of Defense.*

One by one ARPA's projects have been stripped away until now this once-powerful, far-reaching organization controls but four advanced research projects. From a potential of several billion dollars annually, ARPA is now down to some $150 million a year. There's the missile defense project, a long-term solid-propellant development program, a research effort that is investigating methods to police a nuclear test ban, and a materials research program.

Each of these doesn't require—on their combined total—a separate organization. Either we need ARPA or we don't—and events seem to establish clearly that ARPA is regarded as an organization that "must go."

Instead of bleeding it into administrative lifelessness, why not simply carry out the near-corpse? A case of conscience?

—MARTIN CAIDIN

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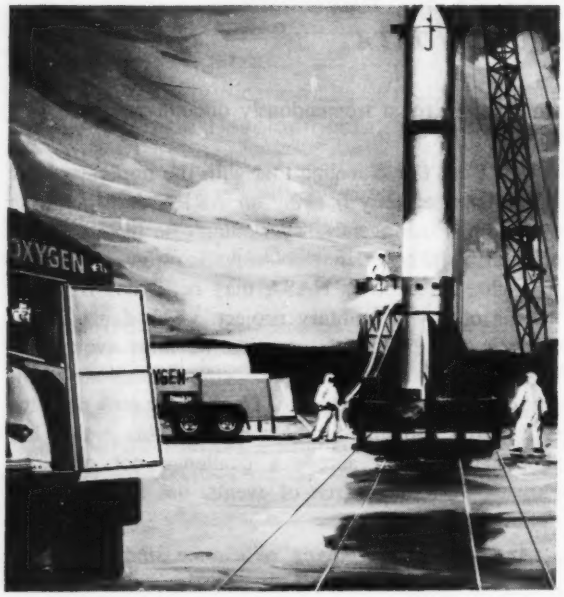

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UNION CARBIDE

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

MILITARY MISSILES, December 1959

AA—Air-to-Air
AS—Air-to-Surface
AU—Air-to-Underwater
SS—Surface-to-Surface
SA—Surface-to-Air
SU—Surface-to-Underwater
UU—Underwater-to-Underwater
ICBM—Intercontinental Ballistic Missile
IRBM—Intermediate Range Ballistic Missile
ECM—Electronic Countermeasures

ATLAS SM-65 AF

Type: ICBM
prime: Convair
guide: GE/Burroughs/Am. Bosch
power: Rocketdyne

Military model achieving operational status. Space research ATLAS-ABLE model receiving more emphasis.

AUTOMET Army

Type: SS
No contracts announced.

Proposed solid propellant close support missile. Designed for "shoot and scoot" Army set-up.

ALBM AF

Type: AS
prime: Douglas
guide: Nortronics
power: Aerojet

Test flight made. Douglas now making one model. Martin and McDonnell have contracts also. This bird is IRBM launched from aircraft.

BOMARC IM-99 AF

Type: SA
prime: Boeing
guide Westinghouse
power: A—Marquardt
B—Thiokol

Model "A" operational but has been receiving criticism. New Model "B" with solid booster expected to be much better.

BULLPUP ASM-N-7 Navy
GAM-83 AF

Type: AS
prime: Martin
guide: radio command
Republic
power: Thiokol

Operational with Atlantic and Pacific Fleets. Very simple radio command weapon.

WHITE LANCE GAM-83 is larger model now in development for AF use.

COBRA Navy

Type: ECM
No contracts announced.

Proposed missile to confuse enemy ship-based radar.

CORPORAL SSM-A-17 Army

Type: SS
prime: Firestone
guide: Gilfillan
power: Ryan

Phasing out in favor of SERGEANT.

CORVUS ASM-N-8 Navy

Type: AS
prime: Temco
guide: Texas Instrument
power: Reaction Motors

Std. model is surface devestator to be launched from carrier a/c. New model being dvlpd as countermeasure (ECM) bird. First fired July '59. Tests continuing.

CROSSBOW GAM-67 AF

Type: AS
prime: Radioplane
guide: Nortronics
power: Westinghouse

Being dvlpd as turbojet powered countermeasure missile and for possible air-to-surface devestation use.

EAGLE XAAM-10 Navy

Type: AA
prime: Bendix
guide: Bendix/Sanders
power: not awarded

EAGLE winning out in political battle against GAR-9 FALCON. Navy has high hopes for EAGLE as attack missile launched from carrier a/c appx. 50 miles from target. Provides safety for manned fighters.

FALCON GAR-1, -2, -3, -4, -9, -11 AF

Type: AA
prime: Hughes
guide: Hughes
power: Thiokol

GAR-3 is operational, SUPER FALCON GAR-3 in test. GAR-9 is so different from the other FALCON series that it really should have other name. Radar guided and with nuclear warhead, AF had high hopes for using this larger and heavier FALCON with F-102, F-106 and ill-fated F-108. But GAR-9 FALCON is now being cut back in production. GAR-11 is in R&D.

GENIE MB-1 AF

Type: AA
prime: Douglas
guide: unguided
power: Aerojet

Now being carried by F-89J, F101B and F-106. First operational nuclear warhead air-to-air bird, GENIE is pointed downward at launch, curves up at target. Unguided. Spin-stabilized.

GIMLET Navy

Type: SA
No contracts announced.

This air-launched rocket is said to have high accuracy. Most details, however, are being withheld by Navy.

MILITARY MISSILES, December 1959

HAWK SAM-A-18 Army
Type: SA
prime: Raytheon
guide: Raytheon
power: Aerojet

Now operational, will be used by both Army and Marine Corps troops against low-level targets.

HONEST JOHN Army
Type: SS
prime: Douglas
guide: unguided
power: Hercules Powder

Operational with U. S. forces in Europe. Slated for replacement by LITTLE JOHN.

HOUND DOG GAM-77 AF
Type: AS
prime: North American
guide: Autonetics
power: Pratt & Whitney (J52)

Becoming operational. On B-52G HOUND DOG is ground devestator. For WS-132A HOUND DOG will be ECM carrier. Ram jet may be used on later models.

JUPITER SM-78 Army-AF
Type: SS
prime: Chrysler
guide: Ford Instrument
power: Rocketdyne

Operational with Italian and Turkish troops in Europe. The 864th and 865th squadrons of SAC trained with JUPITER. THOR replacing.

LACROSSE SSM-A-12 Army
Type: SS
prime: Martin
guide: Federal Tel.
power: Thiokol

This weapon is unique in its design to place a very heavy warhead under command guidance on a battlefield target. LACROSSE is under limited production and is operational. Production is being handled by Martin at Orlando.

LITTLE JOHN Army
Type: SS
prime: Emerson Elec.
guide: unguided
power: Allegheny

Designed for "shoot and scoot" operations, LITTLE JOHN will replace HONEST JOHN as an artillery rocket. It will soon be operational.

LULU Navy
Type: AU
No contracts announced.

Air dropped nuclear warhead anti-sub missile is highly classified by Navy. Now undergoing development. No contract announced.

MACE TM-76 AF
Type: SS
prime: Martin
guide: AC Spark/Goodyear
power: Allison (J33-A-41)

Now in W. Germany with U. S. Forces. Choice of two fine guidance systems in this pilotless aircraft gives MACE extraordinary accuracy.

MATADOR TM-61 AF
Type: SS
prime: Martin
guide: Goodyear
power: Allison (J33-A-37)

Production has now ceased in favor of MACE. MATADORS being turned over to West Germans and Natl. Chinese.

MAULER Army
Type: SA
No contracts announced.

Proposed infra-red guidance anti-air weapon has received no contract.

MINUTEMAN SM-80 AF
Type: ICBM
prime: Boeing
guide: Autonetics
power: Thiokol

Still in development status, MINUTEMAN is expected to become operational solid propellant ICBM (or IRBM in different arrangement of stages) by late 1962 or early 1963. Some trouble has been encountered in the single fixed nozzles of the solid propellant motors.

NIKE-AJAX SAM-A-7 Army
Type: SA
prime: Western Electric
guide: Western Electric
power: Hercules Powder

Now operational in U. S., Europe and Far East. Being replaced by NIKE-HERCULES.

NIKE-HERCULES SAM-A-25 Army
Type: SA
prime: Western Electric
guide: Western Electric
power: Hercules/Thiokol

About 50 NIKE-AJAX batteries have already been converted to the much more powerful NIKE-HERCULES.

NIKE-ZEUS Army
Type: SA
prime: Western Electric
guide: Bell Telephone
power: Grand Central Rocket

Army has high hopes for this anti-missile system. First ZEUS failed in flight in Aug. '59 firing. Tests continuing and funding still high.

PERSHING Army
Type: SS
prime: Martin
guide: Bendix
power: Thiokol

This surface-to-surface MRBM is very slim, delicate looking, which makes it of great contrast in appearance to the thicker JUPITER it is designed to replace. Testing of the solid propellant PERSHING is scheduled to begin shortly at Cape Canaveral.

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

MILITARY MISSILES, December 1959

POLARIS FBM Navy

Type: US-SS
prime: Lockheed
guide: GE
power: Aerojet

Original dreams of 1500 mile range now cut to 900. Progress fairly good altho envisioned operational date of late 1960 now appears optimistic. Designed for launching from both submerged vessels and surface ships, POLARIS is first U. S. designed underwater-to-surface missile. Germans, by the way, had a prototype underwater-to-surface missile working back in WWII.

QUAIL GAM-72 AF

Type: AS-ECM
prime: McDonnell
guide: radio command
power: GE (J85)

Air-launched diversionary missile of extreme sophistication and complexity is valuable aid in protection of SAC bombers. Costly QUAIL, also called GREEN QUAIL, is being readied for test flights in near future.

RAVEN XASM-9 Navy

Type: AS
No contracts announced.

Proposed air-to-surface 500-mile range missile now under study. No contract.

REDEYE ARMY

Type: SA
prime: Convair
guide: Convair
power: Atlantic Research

Lightweight (20 lb.) infra-red guided bazooka-type missile well along in testing. Army has high hopes for this relatively inexpensive and effective easily-carried guided missile that can be fired from a soldier's shoulder. It is the smallest missile ever manufactured by Convair for Defense use.

REDSTONE SSM-A-14 Army

Type: SS
prime: Chrysler
guide: Ford Instrument
power: Rocketdyne

Now operational with U. S. troops in Europe. A very heavy and impressive looking missile, REDSTONE has high reliability and 200-mile range.

REGULUS I SSM-N-8 Navy

Type: SS
prime: Chance Vought
guide: AC Spark Plug
power: Allison (J33)

Although cut in production, REGULUS I is aboard some ships and subs of the U. S. fleet and is operational. Biggest news with REG I, however, is not its current Navy dress but the fact that it has been used in "missile mail" tests by the Post Office Dept. which may do more procurement of missiles for postal delivery test and evaluation.

REGULUS II SSM-N-9A Navy

Type: SS
prime: Chance Vought
guide: Stavid/Sperry/AC
power: GE (J79)

Much more powerful and larger version of REGULUS I, REG II has also been cut from Navy funding but also is being eyed by Post Office Department as speedy ("beyond Mach 2") missile mail carrier that could fly in any weather.

SERGEANT SSM-A-27 Army

Type: SS
prime: Sperry
guide: Sperry
power: Thiokol

Easily assembled in field in about 11 minutes, smaller, more flexible solid propellant SERGEANT is now in production to replace Army's CORPORAL. Nearly operational.

SHILLELAGH Army

Type: SS
prime: Aeronutronics

Lightweight missile designed for close-in support of troops. In one application the SHILLELAGH is vehicle mounted. It is designed to be effective weapon against armor, troops and field fortifications. Expected to become operational in mid-1960's.

SIDEWINDER AAM-N-7 Navy GAR-8 AF

Type: AA
prime: Philco
guide: Philco/GE
power: Hercules Powder

Extremely popular infra-red homing missile is simple and rugged. SIDEWINDER-1C is advanced model with higher speed and greater range. Advanced model is in test. Earlier model is operational. Both AF and Navy use SIDEWINDER.

SLAM AF

Type: SS
No contracts announced.

In study.

SNARK SM-62 AF

Type: SS
prime: Northrop
guide: Northrop
power: Pratt & Whitney (J57)

Highly reliable guided winged missile. Subsonic. Operational with AF unit at Presque Isle, Maine.

SPARROW AAM-N-2, -3, -6 Navy

Type: AA
prime: Raytheon
guide: Raytheon
power: Aerojet

SPARROW III, only one of the SPARROW family now operational, will soon be cancelled from further production. SPARROW III was planned for use on cut F8U-3 and F3H a/c, will still see further use on other fleet a/c including new McDonnell F4H.

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

MILITARY MISSILES, December 1959

SUBROC Navy

Type: SU-UU
prime: Goodyear
guide: Librascope/Kearfott
power: Thiokol

This complex weapons system is launched through a torpedo tube of a submarine or surface vessel. Rising, it flies from 25 to 50 miles through the air, then re-enters the water and homes on its submerged target. Key to perfection of the system is reliability and range of built-in sonar equipment. Work is now continuing along that line.

TALOS SAM-N-6 Navy

Type: SA
prime: Bendix
guide: RCA/Sperry
power: McDonnell

Unique in its integral ram-jet body, TALOS is now operational aboard the guided missile cruiser GALVESTON. A new SUPER TALOS is in planning as a possible anti-missile missile for Navy use.

TARTAR Navy

Type: SA
prime: Convair
guide: Sperry
power: Aerojet

A miniaturized TERRIER that has performance equal to the larger bird, TARTAR is a 950-lb. beam rider. TARTAR is scheduled to be operational in 1960. Test firings now going on in Pacific waters.

TERRIER SAM-N-7 Navy

Type: SA
prime: Convair
guide: Sperry
power: Allegheny

Beam riding missile for use on larger surface ships, TERRIER is operational with the fleet.

THOR SM-75 AF

Type: IRBM
prime: Douglas
guide: AC Spark Plug
power: Rocketdyne

Out of 50 launchings to date, THOR has had 33 successful firings. Now operational, THOR missiles have been sent to the U. K. where they now form 4 units of the Royal Air Force Bomber Command. In its role as a research vehicle, THOR has served as an effective first stage booster, most capably shown in the THOR-ABLE lunar probe combo.

TITAN SM-68 AF

Type: ICBM
prime: Martin
guide: Bell/Am. Bosch/Rem. Rand
power: Aerojet

More sophisticated than ATLAS, ignition of the second stage of TITAN takes place in outer space. Only 1 failure out of 5 launchings to date, TITAN is scheduled for operational use about Jan. 1961. TITAN is designed for underground storage and launch.

WAGTAIL AF

Type: AS
prime: Minn-Honeywell
guide: Minn-Honeywell
power: not releasable

This remarkable rocket will be able to follow contours of terrain and change speed in flight. WAGTAIL has been successfully sled-tested.

WEAPON ABLE Navy

Type: SU
No contracts released.
BuOrd "in-house"

Operational with the fleet, WEAPON ABLE is rocket-powered depth charge now installed on destroyer escorts and class 931 frigates.

ZUNI Navy

Type: AS
No contracts released.
NOTS produced.

Operational with carrier based a/c, ZUNI is a folding fin all-weather unguided rocket carried in multiple units. The Douglas AD a/c carry 48 ZUNIs below their wings on combat missions. The weapon is effective against pill-boxes, tanks, gun emplacements and small ships.

SPACE PROJECTS, December 1959

AGENA ARPA

Type: Liquid-fueled Upper Stage
prime: Bell Aircraft
Obj: AGENA will be useable as a second stage to ATLAS and THOR missiles. It incorporates a Bell rocket engine similar to that used previously in the HUSTLER vehicle. The AGENA upper stage is used in DISCOVERER, MIDAS and other projects. AGENA and SATURN are part of PROJECT TRIBE.

ATLAS-ABLE NASA

Type: Large Booster
prime: Convair/Space Tech Labs
guide: GE/Burroughs/Am. Bosch
power: Rocketdyne/Aerojet
Obj: Designed to orbit 200-lb. satellite around moon.

Initial shot in November failed. Similar shots now delayed until late 1960. However, plans now underway for more ATLAS-ABLE vehicles. Much interest in ATLAS-ABLE combo.

BALLISTIC MISSILE DEFENSE BMEWS AF

Type: Ballistic Missile Defense Radar System
prime: RCA
Obj: Ballistic Missile Early Warning System designed for 40-minute notice of approaching enemy ICBMs.

System to cost around $700 million. Two units ready, one more building. Works with SAGE.

ESAR ARPA

Type: Advanced Warning Radar
prime: Bendix
Obj: Electronically Steerable Array Radar is designed for ground installation to warn of approaching enemy missiles. Multitude of individual cells will give more flexibility than other systems of steerable radar.

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

SPACE PROJECTS, December 1959

PINCUSHION ARPA

Type: Advanced Radar
prime: Raytheon
Obj: PINCUSHION is a many-frequency radar installation to be located on Kwajalein in the Marshall Islands, initially, as an early warning radar of a more variable type than TRADEX or ESAR.

TRADEX ARPA

Type: Advanced Radar
Prime: RCA
Obj: TRADEX is a modification of the radar types recently designed for BMEWS (Ballistic Missile Early Warning System). It should have better range.

CENTAUR NASA

Type: Soft-Land Moon Vehicle
prime: Convair
power: P&W/JPL
Obj: Designed to land 730-lb. payload on moon in soft landing.

A new liquid hydrogen engine is being dvlpd for the upper stage of this ATLAS-boosted vehicle. New JPL engine will have 6000-lbs. thrust.

COURIER ARPA (Army)

Type: Communications Satellite
prime: not announced
Obj: Designed to be delayed repeater satellite, part of PROJECT NOTUS.

Primarily in-house project. FY 59 funding: $3 million.

DECREE ARPA (Army)

Type: Global Communications Satellite
prime: no contracts announced
Obj: Designed to be global communications system with satellite repeaters remaining stationary distances from each other.

Part of NOTUS, will be transferred from ARPA to Army eventually.

PROJECT DEFENDER ARPA

Obj: Ballistic Missile Defense

ESAR, TRADEX and PINCUSHION are only part of the entire ballistic missile defense program of ARPA. The GLIPAR studies, (Guide Line Identification Program for Anti-Missile Research) is also a part of Project DEFENDER.

PROJECT DISCOVERER AF

Type: Stabilized Satellites
Obj: (a) Achieve orbital capabilities of large satellite vehicles.
(b) Dvlp techniques and data for operational military satellite systems.
(c) Recover by use of suitable re-entry capsule for biomedical and other studies.
(d) Execute nonrecoverable advanced engineering tests.
(e) Such other objectives as may be directed.

Tasks: **DISCOVERER** satellites
Prime: Lockheed
Has achieved orbital capabilities and has made successful re-entries. Ejected capsules have not been recovered.
MIDAS Satellites
Prime: Lockheed
In R&D, Early Warning Satellite dvlpd to spot enemy ICBM launchings by infrared.
SAMOS Satellites
Prime: Lockheed
Originally called SENTRY, first launching scheduled for March 1960.

DYNA-SOAR I AF

Type: Boost-Glide Orbiting Vehicle
prime: Boeing/Bell/Martin competing
guide: not announced
power: not announced
Obj: Will attempt to put manned glider into orbit for pilot to return.

Competition is underway between Boeing, Bell and Martin for contract to produce. Each has made proposals under study. Project soon to enter R&D from study stage.

GLIPAR ARPA

Type: Study Group for Missile Defense
Obj: Designed to work on future ICBM defense. Called upon by DEFENDER and LONGSIGHT.

JUNO II NASA

Type: Large Booster
prime: Chrysler
guide: Ford Instrument
power: Rocketdyne/JPL
Obj: Attempts to put small payloads deep in space.

Five more JUNOs will be fired.

PROJECT LONGSIGHT ARPA

Type: Study System in Missile/Space Field
Obj: Recommendations as to projects which should be initiated to satisfy future military requirements. GLIPAR (Guide Line Identification Program for Anti-Missile Research) which was initiated. GLIPAR is now used by both LONGSIGHT and DEFENDER. LONGSIGHT more advanced than DEFENDER.

MERCURY NASA

Type: Manned Satellite
prime: McDonnell
guide: not announced
power: ATLAS (Rocketdyne)
Obj: Will attempt to put man in brief orbit, then parachute him in capsule safely to earth.

Capsules have been built, astronauts selected and firings being made on LITTLE JOE and REDSTONE test vehicles.

MIDAS WS 117L AF (Via ARPA)

Type: Early Warning Satellite
prime: Lockheed
Obj: Infrared sensing of enemy ICBM launchings.

Also part of the original SENTRY program and now handled in the DISCOVERER series. MIDAS has been initiated to dvlp an early warning system of defense against ICBMs wherein the heat from the missile motors is detected at time of launch. Infrared detection is used. Still in dvlpmnt.

MRS. V ARPA

Type: Maneuverable, Recoverable Manned Space Vehicle
prime: no contract announced
guide: no contract announced
power: no contract announced
Obj: Will attempt to place manned vehicle in orbit, then maneuver out of original orbit in space, then return safely to earth.

This project is also known as DYNA-SOAR II. Vehicle will weigh in excess of 20,000 lbs. Launch may be from or in space. Although far from current state of art, MRS. V will be pushed by ARPA to receive substantial funding in 1960 because of its high importance.

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

SPACE PROJECTS, December 1959

NOVA NASA

Type: Large Booster
prime: Rocketdyne
power: Rocketdyne
Obj: Will build 6 million lb. thrust booster for Outer Space Vehicles

Rocketdyne's 1.5 million lb. thrust engine is heart of this system. NOVA will be cluster of 4 such engines. Engine in early dvlpmnt now.

NOVA is designed to carry 1-ton load to moon and back; 7500 lbs. to Mars with 750-lb. return load. Nuclear version would take 27 tons to Mars, bring 12 tons back.

ORION ARPA

Type: Rocket propelled by nuclear pulses
prime: General Atomic
Obj: Nuclear powered Outer Space Vehicle

Work was undertaken in July '58 by Gen. Atomics Div. of General Dynamics under a $1 million contract with ARDC. An additional $400,000 was authorized by ARPA at end of year for continuation of study In Aug. '59 another $1 million for continuation of nuclear pulse rocket studies was authorized. Still in drawing board stages.

PRINCIPIA ARPA

Type: Solid Propellants
prime: no contracts announced
Obj: Dvlping new solid propellants with 10-20 percent higher specific impulses.

PONTUS ARPA

Type: Material Research
prime: no contracts announced
Obj: Experimentation and dvlpmnt of better structural and power conversion matls for military requirements in surface, air and missile programs.

SAMOS WS 117L AF (via ARPA)

Type: Reconnaissance Satellite
prime: Lockheed
Obj: TV Satellite

Originally called SENTRY, the SAMOS is part of the DISCOVERER series designed to be a "Peeping Tom" on enemy military capabilities. It is scheduled for initial launch in March 1960.

SATURN NASA

Type: Large Booster
prime: Convair
power: Pratt & Whitney
Obj: Clustered 1.5 million lb. thrust booster for Outer Space Vehicles.

Recently transferred from Army to NASA control along with Von Braun and SATURN project officers and tech people. SATURN with two stages above it—probably TITAN and CENTAUR—could send 20,000 lbs. to moon or put heavy probe deep in space. First launchings are scheduled to be in early 1963.

SCOUT NASA

Type: Four-stage Satellite Launch Vehicle
prime: Chance Vought
guide: Minn-Honeywell
power: Aerojet/Allegany/Thiokol
Obj: Designed to place 200-300 lb. satellites in orbit.

SCOUT is now in late stages of dvlpmnt, expected to be operational abt March 1960.

SHEPARD ARPA

Type: Tracking Satellite
prime: no contracts announced
Obj: Tracking and data reduction

STEER ARPA

Type: Communications Satellite
prime: Bendix
Obj: Destined to serve the Strategic Air Command for communications purposes, STEER is part of the NOTUS project. STEER will be launched in a polar orbit. Still in R&D. Army will dvlp the satellite, AF will launch it.

SUZANO ARPA

Type: Space Platform
prime: no contracts announced
Obj: Designed to provide space platform for assembling Outer Space Vehicles, and to be used as a springboard base for advanced space missions.

Altho no funding has yet been advocated for this space platform, SUZANO is a definite necessity and will surely be a reality. Initially the project' assignment will be directed toward the demonstration of the feasibility of such an operational space base. SUZANO is now in study stage.

THOR-ABLE NASA

Type: Large Booster
prime: Douglas/Space Tech Labs
guide: GE
power: Rocketdyne/Aerojet
Obj: Designed for deep space probes of lighter payloads than ATLAS-ABLE.

Good reliability has been had with this combination. Uses continuing for putting probes deep in space and for moon and sun orbit shots.

THOR-DELTA NASA

Type: Satellite Launching Vehicle
prime: Space Tech Lab
guide: ITT
power: Aerojet/Allegany
Obj: Designed to put small satellites (50-80 lbs.) into orbit around moon.

First flights scheduled for early 1960.

TIROS NASA

Type: Meteorological Satellite
prime: RCA
Obj: Designed to take television pictures of cloud formations and frontal systems.

TIROS promises to give more revelations about nature of weather. Army Signal R&D Labs at Fort Monmouth involved in initial planning. Navy is also fostering TIROS. Shot is planned for mid-year 1960.

PROJECT TRANSIT ARPA

Obj: Astro-Geodetic Navigation Satellite

PROJECT TRANSIT is a research, experimentation and systems dvlpmnt designed to obtain astro-geodetic navigation capabilities based on satellite or other space vehicle applications and capable of satisfying the operational requirements of the military services. Navy will receive this project from ARPA in future. The Applied Physics Lab of Johns Hopkins has a study contract now on TRANSIT.

DATALOG OF MILITARY MISSILES AND SPACE PROJECTS

SPACE PROJECTS, December 1959

PROJECT TRIBE ARPA

Obj: Outer Space Vehicles

PROJECT TRIBE is a research, experimenfation and systems dvlpmnt designed to obtain at the earliest practical date a continuing family of military space vehicles capable of satisfying the needs for space missions as may be determined by Secretary of Defense from time to time. Guidance, stabilization and control components necessary to satisfactory performance of the vehicles shall be included in the scope of this assignment. The SATURN Task and AGENA Task are part of Project TRIBE.

VEGA NASA

Type: Solar System Probe Vehicle
prime: Convair/JPL
guide: GE
power: Rocketdyne/GE/JPL
Obj: Designed to probe moon, Mars and Venus.

VEGA was being built to be able to send 1000 lbs. to Mars; 6000 lbs. in earth orbit. The project was cancelled 11 December 1959.

VELA ARPA

Obj: Research, experimentation and systems dvlpmnt related to the nuclear test moratorium.

X-15 AF/Navy/NASA

Type: Rocket-Powered Manned Aircraft
prime: North American
power: Thiokol
Obj: Designed to take man in controlable a/c to fringes of outer space—100,000-ft. altitude, at speed of Mach 5 (better than 3600 mph.).

Drop tests and partial power tests have been successful. Recently, however, plane broke its back on rough landing. No injuries to pilot, Scott Crossfield. Rebuilding, studies and tests continuing.

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Businessmen in Defense-Industry Answer DATA Questions . . .

THE WASHINGTON REP REPORTS

FOR SOME time now we at Data Publications have felt the need of some sort of an association in order to (1) bring our Government contractor subscribers and users of our services in closer contact, (2) establish an advisory body that could give us more insight as to what paths in editorial selection and dissemination would be of most benefit to subscribers, (3) add weight to our requests when we deal with agencies of the Department of Defense, and (4) make it possible to have luncheons and symposiums where successful qualified procurement personnel, ranking executives of the Government and Government contractors of our association would speak, explain procedures and make it possible for other members to make new contacts and more profitable ventures.

QUESTION:

Do you think there is a need for an association of buyers and sellers in government and industry which would work towards introducing government agencies to contractors, and introducing prime contractors to more sub-contractors?

Mr. Bernard B. Smyth
East Coast Manager
General Atomic Corp.
1710 H Street, N. W.
Washington 6, D. C.

My first reaction is that we have quite a few associations in Washington, and I believe that a prospective member would find it necessary to differentiate your proposed group from the others before he would be interested. On the other hand, you have done an excellent job with your DATA Magazine and have satisfied a need which existed but which was not recognized by too many of us until your publications were available.

Mr. S. Bromfield
Royal Corp.

Assume like NSIA. Sounds all right but I'm too new to commit.

Mr. James E. Mills, Jr.
Rosan, Inc.
Shorehan Building
15th & H Street, N. W.
Washington 5, D. C.

My immediate reaction to your proposal is that such an organization could be successful only if supported by a massive effort on the part of the organizer and participating industrial concerns. The prime problem as I see it would be to avoid the classification of just another Washington luncheon group. Unless something unique made it desirable that they (companies involved with Government contracts) participate, I fear that you may find it difficult to generate sincere enthusiasm.

Mr. Harold Pryor
District Engineering Manager
Janitrol Aircraft Division
Columbus 4, Ohio

I think that a Government Contractors Association could be of great value if you could get participation by Government Procurement personnel. Of course I mean actual participation where we would have an active portion of the membership who were Government Procurement types. Most of these associations manage to get you well acquainted with your various competitors but that is about all.

R. R. Parker
Government Liaison Office
American Bosch Arma Corp.

Such an organization would undoubtedly prove useful to many government suppliers.

William Roberts
Southern Oxygen Co.

I look with favor on association for the function as outlined by DATA.

Gordon Lennon
Government Sales Div.
National Cash Register

Such an organization badly needed. I believe it should be composed of leading data processing companies, qualified government personnel, project officers, etc.

datagraf PERSONNEL LOCATOR CHARTS AND REPORTS FOR DECEMBER 1959

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For the initial activity covered by DATA ERRATA, subscribers, through their letters, selected OSD R&E (Office of the Secretary of Defense, Director of Research & Engineering).

For $10 a month, subscribers to DATA ERRATA Nbr. 1, covering OSD R&E, now receive (1) a special newsletter giving news of happenings as they occur in this Defense activity, (2) phone and room listings of personnel of the activity with constant revisions of these lists as changes occur, (3) special personality resumes of the key personnel of the activity including their approach to new concepts, hobbies, etc., (4) frequently revised DATAGRAF-type charts with automatic replacement of outdated charts by new ones, eliminating the subscribers need to place reorders.

It all adds up to flawless coverage of a given Government activity including the providing of a special expandable file folder to hold the biographies, personality appraisals, charts, newsletters, phone lists, etc., which are sent regularly to DATA ERRATA subscribers.

DATA ERRATA DE-1 subscribers now include *ACF Industries, Aeronutronic Division of Ford, Autonetics, Burroughs, Chance Vought, Chrysler, General Electric, Grumman, Martin, North American Aviation, Polytechnic R&D Co., Ramo-Wooldridge, Space Tech. Labs, Western Electric,* and others that use DATA ERRATA to do their leg-work.

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We are therefore, now, initiating a new DATA ERRATA service:

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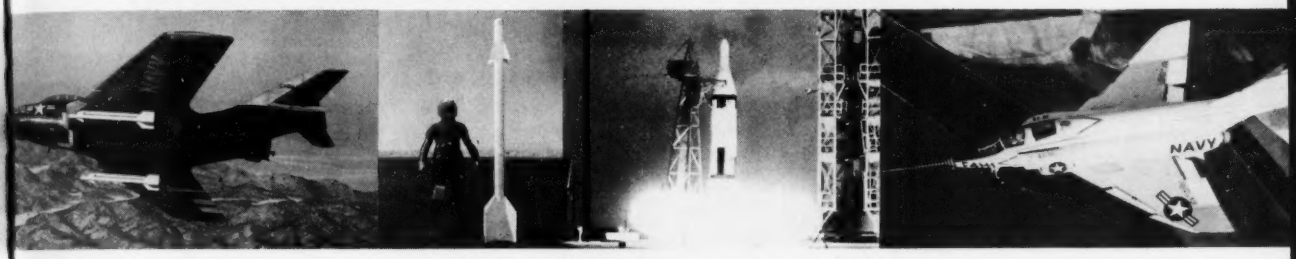

DATA'S FEBRUARY 1960 EDITION

DID you know that 70 percent of the Navy's R&D budget will be spent in the new Navy Bureau of Naval Weapons? The new Bureau combines the Bureau of Aeronautics and the Bureau of Ordnance into one solid force for the forging of the weapons of naval readiness.

DATA's special issue highlighting the Bureau of Naval Weapons will be the most complete treatise yet made on "BuWeps" and will be an issue that Defense-Industry, Naval Officers, and other executives interested in Naval Strength and National Security will want to keep and refer to time after time throughout the year.

You'll get to know names like Morrie Hirsch, Bill Schoech, and Paul Stroop a lot better through this "BuWeps" issue of DATA. And these fine officers and their executive assistants and working level forces will be in this issue along with their room numbers and phone extensions wherever available in chain of command block diagram.

This "BuWeps" issue will be the biggest and most complete book on a given Government activity that DATA has ever done. We wish to thank Rear Admiral Schoech, Deputy Director of the Bureau, and Commander Russ Bufkins, the Navy's Magazine and Book Branch Director, for making this issue possible.

Here is a reference book we are proud to present that will be seen time and time again by all concerned with naval readiness.

Deadline for advertising copy and layout in this Bureau of Naval Weapons issue is the 11th of January. Don't miss getting your ad in this reference book.

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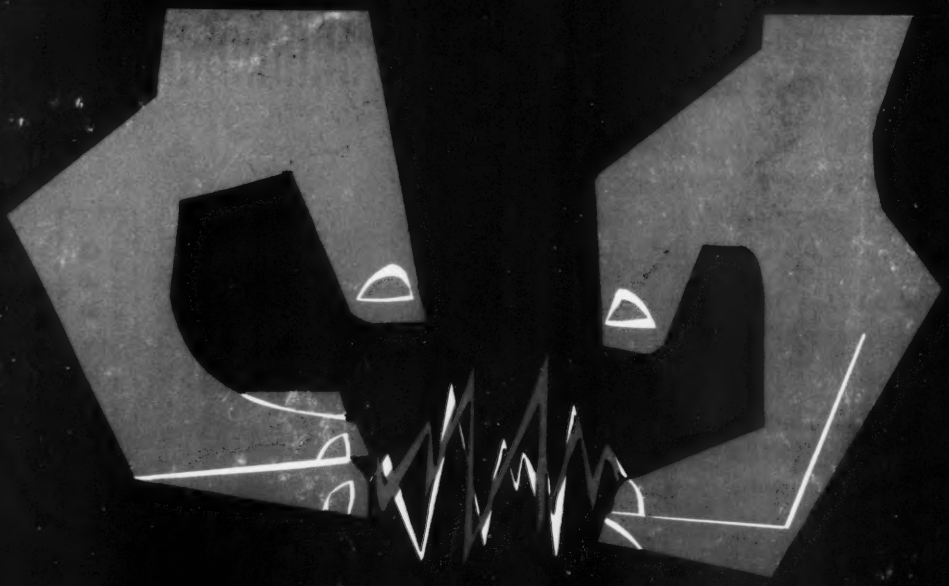

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